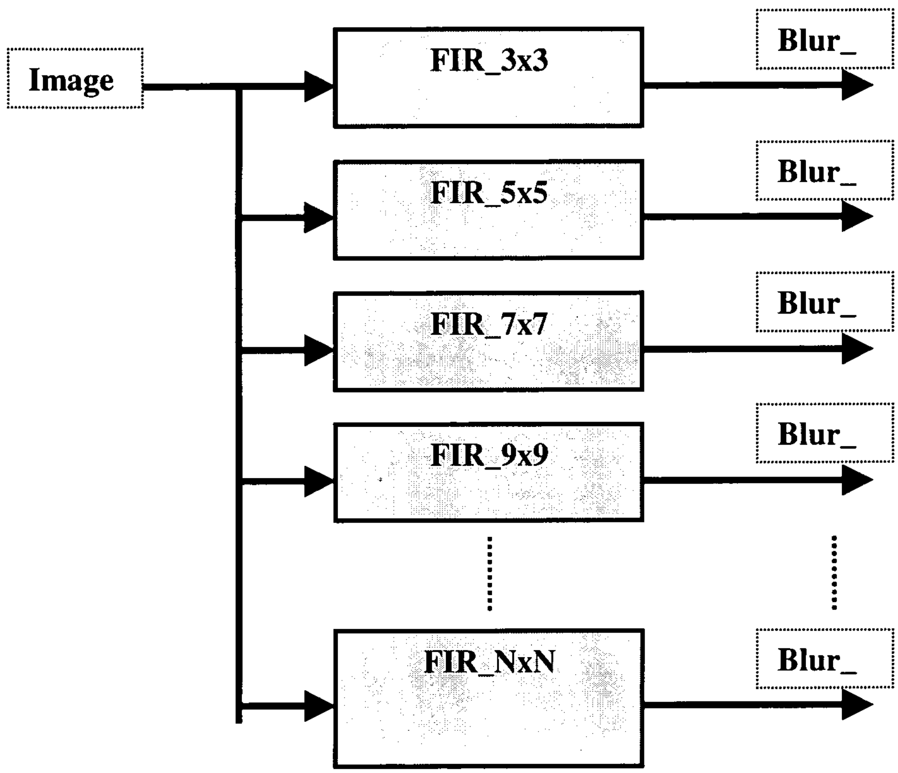
Image
FIR_3x3
FIR_5x5
FIR_7x7
FIR_9x9
FIR_NxN
Blur_
Blur_
Blur_
Blur_
Blur_

FIG. 1

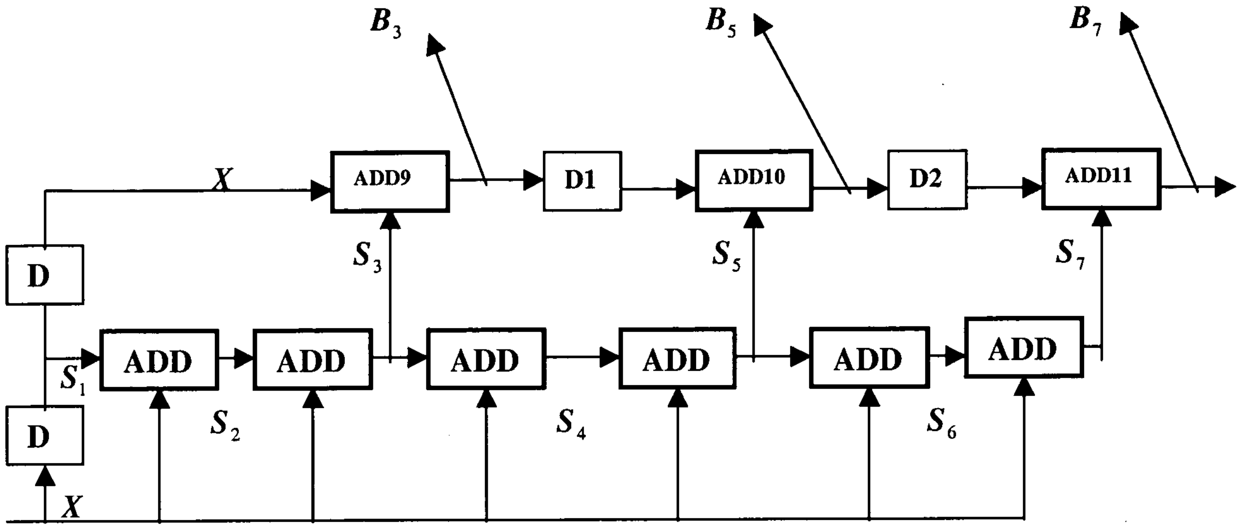
$B_3$
$B_5$
$B_7$
$X$
ADD9
D1
ADD10
D2
ADD11
$S_3$
$S_5$
$S_7$
D
ADD
ADD
ADD
ADD
ADD
ADD
$S_1$
D
$S_2$
$S_4$
$S_6$
$X$

FIG. 2

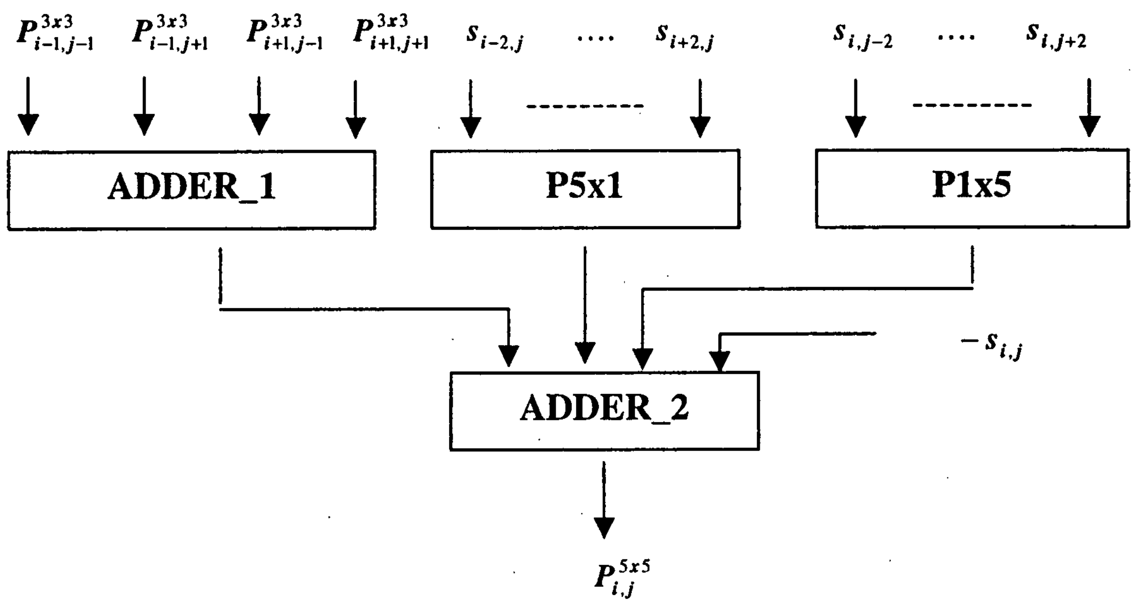
$P^{3x3}_{i-1,j-1}$
$P^{3x3}_{i-1,j+1}$
$P^{3x3}_{i+1,j-1}$
$P^{3x3}_{i+1,j+1}$
$s_{i-2,j}$ .... $s_{i+2,j}$
$s_{i,j-2}$ .... $s_{i,j+2}$
ADDER_1
P5x1
P1x5
$-s_{i,j}$
ADDER_2
$P^{5x5}_{i,j}$

FIG. 3

FIG. 4

$$
\boldsymbol{P}^{kxk} = \begin{bmatrix}
\boldsymbol{P}_{0,0}^{kxk} & \boldsymbol{P}_{0,1}^{kxk} & . & \cdots & . & . & \boldsymbol{P}_{0,N-1}^{kxk} \\
\boldsymbol{P}_{1,0}^{kxk} & \boldsymbol{P}_{1,1}^{kxk} & . & . & . & . & \boldsymbol{P}_{1,N-1}^{kxk} \\
. & . & . & . & . & . & . \\
\vdots & . & . & \boldsymbol{P}_{i,j}^{kxk} & . & . & \vdots \\
. & . & . & . & . & . & . \\
. & . & . & . & . & . & . \\
\boldsymbol{P}_{M-1,0}^{kxk} & \boldsymbol{P}_{M-1,1}^{kxk} & . & \cdots & . & . & \boldsymbol{P}_{M-1,N-1}^{kxk}
\end{bmatrix}
$$

FIG. 5

$$
S = \begin{bmatrix}
s_{0,0} & s_{0,1} & \cdot & \cdots & \cdot & \cdot & s_{0,N-1} \\
s_{1,0} & \cdot & \cdot & \cdot & \cdot & \cdot & s_{1,N-1} \\
\cdot & \cdot & s_{i-1,j-1} & s_{i-1,j} & s_{i-1,j+1} & \cdot & \cdot \\
\vdots & \cdot & s_{i,j-1} & s_{i,j} & s_{i,j+1} & \cdot & \vdots \\
\cdot & \cdot & s_{i+1,j-1} & s_{i+1,j} & s_{i+1,j+1} & \cdot & \cdot \\
\cdot & \cdot & \cdot & \cdot & \cdot & \cdot & \cdot \\
s_{M-1,0} & s_{M-1,1} & \cdot & \cdots & & \cdot & s_{M-1,N-1}
\end{bmatrix}
$$

$$
F_{kxk} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ \vdots \\ \frac{k-1}{2} \\ \vdots \\ 3 \\ 2 \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 2 & 3 & \cdots & \frac{k-1}{2} & 4 & 3 & 2 & 1 \end{bmatrix}
$$

$$
= \begin{bmatrix}
1 & 2 & 3 & \cdots & \frac{k-1}{2} & \cdots & 3 & 2 & 1 \\
2 & 4 & 6 & \cdots & \frac{2(k-1)}{2} & \cdots & 6 & 4 & 2 \\
3 & 6 & 9 & \cdots & \frac{3(k-1)}{2} & \cdots & 9 & 6 & 3 \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
\frac{k-1}{2} & \frac{2(k-1)}{2} & \frac{3(k-1)}{2} & \cdots & \frac{(k-1)*(k-1)}{4} & \cdots & \frac{3(k-1)}{2} & \frac{2(k-1)}{2} & \frac{k-1}{2} \\
\vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\
3 & 6 & 9 & \cdots & \frac{3(k-1)}{2} & \cdots & 9 & 6 & 3 \\
2 & 4 & 6 & \cdots & \frac{2(k-1)}{2} & \cdots & 6 & 4 & 2 \\
1 & 2 & 3 & \cdots & \frac{k-1}{2} & \cdots & 3 & 2 & 1
\end{bmatrix}
$$

FIG. 6

$$F_{9x9} = \begin{bmatrix} 1 \\ 2 \\ 3 \\ 4 \\ 5 \\ 4 \\ 3 \\ 2 \\ 1 \end{bmatrix} * \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1 \end{bmatrix} = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1 \\ 2 & 4 & 6 & 8 & 10 & 8 & 6 & 4 & 2 \\ 3 & 6 & 9 & 12 & 15 & 12 & 9 & 6 & 3 \\ 4 & 8 & 12 & 16 & 20 & 16 & 12 & 8 & 4 \\ 5 & 10 & 15 & 20 & 25 & 20 & 15 & 10 & 5 \\ 4 & 8 & 12 & 16 & 20 & 16 & 12 & 8 & 4 \\ 3 & 6 & 9 & 12 & 15 & 12 & 9 & 6 & 3 \\ 2 & 4 & 6 & 8 & 10 & 8 & 6 & 4 & 2 \\ 1 & 2 & 3 & 4 & 5 & 4 & 3 & 2 & 1 \end{bmatrix}$$

FIG. 7

$$
\boldsymbol{P}^{1xk} = \begin{bmatrix}
P^{1xk}_{0,0} & P^{1xk}_{0,1} & . & \cdots & . \; . & P^{1xk}_{0,N-1} \\
P^{1xk}_{1,0} & P^{1xk}_{1,1} & . & . & . \; . & P^{1xk}_{1,N-1} \\
. & . & . & . & . \; . & . \\
\vdots & . & . & P^{1xk}_{i,j} & . \; . & \vdots \\
. & . & . & . & . \; . & . \\
. & . & . & . & . \; . & . \\
P^{1xk}_{M-1,0} & P^{1xk}_{M-1,1} & . & \cdots & . \; . & P^{1xk}_{M-1,N-1}
\end{bmatrix}
$$

FIG. 8

$$
P^{kx1} = \begin{bmatrix}
P_{0,0}^{kx1} & P_{0,1}^{kx1} & . & \cdots & . & . & P_{0,N-1}^{kx1} \\
P_{1,0}^{kx1} & P_{1,1}^{kx1} & . & . & . & . & P_{1,N-1}^{kx1} \\
. & . & . & . & . & . & . \\
\vdots & . & . & P_{i,j}^{kx1} & . & . & \vdots \\
. & . & . & . & . & . & . \\
. & . & . & . & . & . & . \\
P_{M-1,0}^{kx1} & P_{M-1,1}^{kx1} & . & \cdots & . & . & P_{M-1,N-1}^{kx1}
\end{bmatrix}
$$

FIG. 9